Statistical inference peer assessment part 2

Introduction

In this analysis we are going to use the Tooth Growth dataset found within R. This dataset records the growth of the length of teeth in guinea pigs when administered Vitamin C at varying doses and delivery methods. We will look at confidence intervals to compare tooth growth by supplement and dose.

Load the ToothGrowth data and perform some basic exploratory data analyses

```
data(ToothGrowth)
str(ToothGrowth)
```

```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

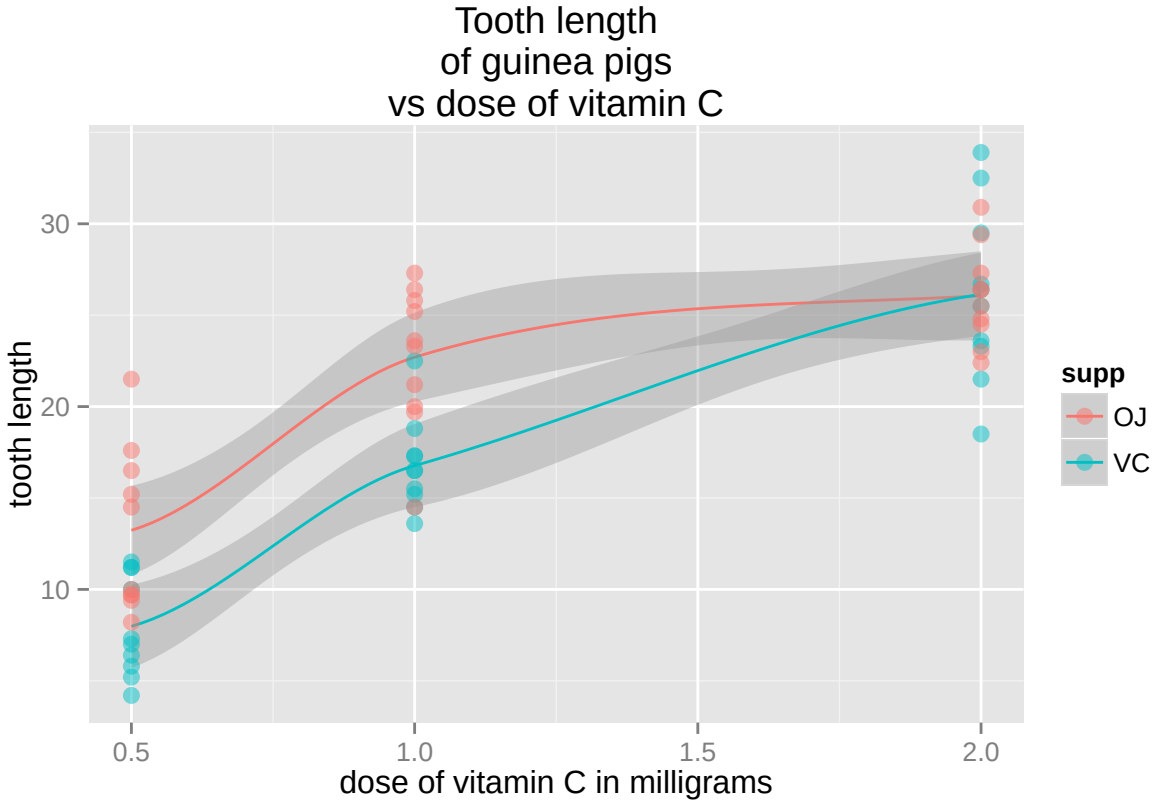
```
unique(ToothGrowth$dose)
```

```
## [1] 0.5 1.0 2.0
```

As we can see, there are 60 observations and 3 variables: a numeric "len", a factor "supp", a numeric "dose".

The "len" variable represents Guinea Pig tooth length. The "supp" variable represents one of two delivery methods (OJ = orange juice, VC = ascorbic acid). And "dose" variable represents one of three dose levels of vitamin C in milligrams (0.5, 1, 2).

```
library(ggplot2)
options(warn=-1)
ggplot(ToothGrowth, aes(x = dose, y = len, group=supp))+
  stat_smooth(method=loess,aes(color=supp))+
  geom_point(size =3, alpha = .5,aes(color=supp))+
  xlab("dose of vitamin C in milligrams")+
  ylab("tooth length")+
  ggtitle("Tooth length\nof guinea pigs\nvs dose of vitamin C")
```



As we can see by our exploratory analysis, as dosage of vitamin C increases , so does the tooth length. This applies for both delivery methods.We can also see from the graph (lines) that orange juice is more efficient than the ascorbic acid for doses 0.5 and 1 and equally efficient for dose 2. We can see the same thing from the confidence intervals.

Looking at confidence intervals and results

We are going to perform these tests using the parameter paired=FALSE because the guinea pigs that received the orange juice are separate from the guinea pigs that received the ascorbic acid. We will also set unequal variances.

```
ToothGrowth$dose <- as.factor(ToothGrowth$dose)
g_0.5_OJ<-subset(ToothGrowth,dose==0.5&supp=="OJ")
g_1_OJ<-subset(ToothGrowth,dose==1&supp=="OJ")
g_2_OJ<-subset(ToothGrowth,dose==2&supp=="OJ")

g_0.5_VC<-subset(ToothGrowth,dose==0.5&supp=="VC")
g_1_VC<-subset(ToothGrowth,dose==1&supp=="VC")
g_2_VC<-subset(ToothGrowth,dose==2&supp=="VC")
```

First we conduct t-tests between groups seperated by supplement and for the same doses.

```
t.test(g_0.5_OJ$len,g_0.5_VC$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1] 1.719057 8.780943
```

```
## attr(,"conf.level")
## [1] 0.95
```

```
t.test(g_1_OJ$len,g_1_VC$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1] 2.802148 9.057852
## attr(,"conf.level")
## [1] 0.95
```

```
t.test(g_2_OJ$len,g_2_VC$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1] -3.79807  3.63807
## attr(,"conf.level")
## [1] 0.95
```

As we can see from the confidence intervals for doses 0.5 and 1 the orange juice is better suplemnet. But for dose 2 the two supplemnts are equally good, because the confidence interval contains 0.

Now we conduct t-tests between groups seperated by dose and for the same supplement

```
t.test(g_1_OJ$len,g_0.5_OJ$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1]  5.524366 13.415634
## attr(,"conf.level")
## [1] 0.95
```

```
t.test(g_2_OJ$len,g_1_OJ$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1] 0.1885575 6.5314425
## attr(,"conf.level")
## [1] 0.95
```

As we can see from the intervals bigger dose of orange juice bigger teeth.

```
t.test(g_1_VC$len,g_0.5_VC$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1]  6.314288 11.265712
## attr(,"conf.level")
## [1] 0.95
```

```
t.test(g_2_VC$len,g_1_VC$len,paired = FALSE, var.equal = FALSE)$conf
```

```
## [1]  5.685733 13.054267
## attr(,"conf.level")
## [1] 0.95
```

Bigger dose of VC, bigger teeth for guinea pigs.

Conclusion

The confidence intervals agree with the graph. From these data only, we can conclude if we want teeth with bigger length for guinea pigs, we should give them 2 milligrams dosage of vitamin C, by either supplement orange juice or ascorbic acid.